Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

A280.39
M34Am
Cop.4

LIBRARY
CURRENT SERIAL RECORD
MAY 5 - 195
U.S. DEPARTMENT OF AGRICULTURE

THE EFFECT OF PRESTORAGE PACKINGHOUSE TREATMENTS ON THE CONTROL OF DECAY OF FLORIDA ORANGES

During Storage at

Orlando, Florida, and New York City, N. Y., 1951

By

Paul L. Harding, James S. Wiant
H. W. Hruschka, M. Bryan Sunday
J. Kaufman

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service
Biological Sciences Branch

AMS-233 (formerly H. T. & S. 266)

Washington, D. C.

This report was previously issued March 1952 by the Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, as H. T. & S. Office Report No. 266; it was reissued in April 1958, without change in text, by the Agricultural Marketing Service.

Agriculture-Washington April 1958

THE EFFECT OF PRESTORAGE PACKINGHOUSE TREATMENTS ON THE CONTROL OF DECAY OF FLORIDA ORANGES DURING STORAGE [1]

ORLANDO, FLORIDA, AND NEW YORK CITY, N. Y.

1951

This is a report of the 1951 storage experiments with Valencia oranges conducted at Orlando, Fla., and New York, N. Y. The tests were a part of the investigation on the storage of citrus fruits conducted by the Bureau of Plant Industry, Soils and Agricultural Engineering, and The Refrigeration Research Foundation.

SUMMARY

Valencia oranges that had been treated with Dowicide A-hexamine solution in the dip tank developed much less decay in storage than did similar untreated fruit. A borax dip treatment made 24 hours prior to the Dowicide A-hexamine treatment gave added control of decay, and the use of phenodor (diphenyl-treated) box liners reduced it still further. It would appear that the Dowicide A-hexamine treatment supplemented by either the phenodor box liner or the phenodor-treated corrugated fiberboard carton offers an excellent method of controlling decay in stored fruit. In the present tests fruit so treated developed less than 5 percent decay when held for seven days at 70° F. following sixteen weeks' storage at 32° F. A borax dip 24 hours prior to the Dowicide A-hexamine treatment as mentioned above gave additional control of storage decay, and when used in combination with phenodor liners held decay to less than 2 percent in fruit stored sixteen weeks at 32° F. and seven days at 70°.

Loss in weight among the lots with different packinghouse treatments ranged between 3.3 to 3.6 percent. The naked packs of oranges lost 4.2 percent as compared with 2.7 percent for fruit packed in boxes with phenodor liners.

---

[1] Acknowledgement is due W. T. Pentzer, U. S. Department of Agriculture, Beltsville, Md., and H. C. Diehl, Director of The Refrigeration Research Foundation, Colorado Springs, Colo., and to the following staff members of the Division of Handling, Transportation, and Storage of Horticultural Crops: Arthur Dickinson, B. A. Friedman, Neil Gardner, W. A. Radspinner, and G. Lee Roberts. Acknowledgement is also due the following growers, shippers, and cold storage warehouse officials for their generous cooperation: American Fruit Growers, Inc., George W. Boutilier, John J. Brossard, Chase and Co., Randall Chase, Frank Chase, Sydney Chase, Paul B. Christensen, Citrus Container Institute, Albert P. Connelly, J. V. D'Alboro Co., Egan-Fickett Co., Haines City Citrus Growers Assn., Arnold Hampson, Corbett Hutchinson, A. J. Kackenmester, W. Kinney, J. I. Lyle III, Merchants Cold Storage and Warehouse Co., Providence, R. I., Merchants Refrigerating Co., New York City, A. B. Michael, Nevins Fruit Co., Orlando Citrus Growers Assn., Arthur N. Otis, J. J. Parrish, Dr. P. Phillips Co., R. V. Phillips, A. E. Pickard, Raymond D. Robinson, Roper Growers Coop., Frank Roper, Mrs. Charlotte Roper, Frank Sharp, Waverly Growers Coop., Brantley A. Weathers, Jr., Weathers' Packaging Co., and J. G. Welsh.

Good control of decay was obtained when the fruit for storage was packed in phenodor-treated fiberboard cartons or in Bruce boxes with phenodor-treated box liners. Nevertheless, the smallest amounts of total of decay occurred when the fruit was packed in the phenodor-treated fiberboard cartons.

Considerable variation in storage quality was found in fruit from different groves.

Size of fruit influenced keeping quality; a greater amount of decay was noted in the large sizes (126 and 150 per box) than in smaller sizes (176 to 250 per box).

Tests showed that rootstocks affected storage quality of the oranges and that smaller amounts of decay occurred in the fruit on sour and sweet orange than in the fruit on rough lemon rootstock.

Six commercial carloads were stored in good condition for four to seven weeks at 32° at Providence, R. I., and Newark, N. J., but owing to unfavorable market conditions no profit was made by the venture. Favorable results were obtained in phenodor-treated fiberboard cartons but their slower cooling in transit offset some of their advantages in retarding decay. The added treatment of Dowicide A-hexamine may be advisable.

On the basis of results presented elsewhere in this report it would appear very worthwhile to treat all oranges going into storage with Dowicide A-hexamine and to use diphenyl-treated liners as an added precaution.

It is also suggested that shippers grade fruit more carefully and avoid storing poor quality, weak fruit.

MATERIALS AND METHODS

The fruit for the tests, unless specified, was limited to sizes 150, 176, 200, 216, and 250, and was packed mostly in Bruce boxes with phenodor-treated liners. The oranges for these tests were obtained from nine different shippers and were representative of the commercial pack and quality being marketed at that season of the year.

At Orlando and New York, the cold storage rooms were operated at 32° F. The rooms were checked frequently and continuous records were obtained by hygro-thermographs. Except for minor fluctuations the temperatures were maintained within a narrow range.

Methods of procedure and of inspection of fruit were much like those used in 1949 and 1950. In scoring the several types of skin breakdown, a given fruit showing both aging and pitting was scored under the defect that was considered the more serious blemish. Decay was always considered more serious than any type of skin breakdown. Decayed fruits were classified under stem-end rot when the symptoms were characteristic of Diplodia rot or Phomopsis rot, even though the decay occurred elsewhere than at the stem end. Three inspections were made on each box of fruit; namely, at the time the boxes were removed from storage, three days after removal, and seven days after removal. During this seven-day holding period the temperature was 70° F. and the relative humidity 70 to 90 percent.

The phenodor (diphenyl-treated) liners, where used, were removed at the first inspection. Decayed oranges were removed and discarded at the first and second inspections and the sound fruit was repacked into the test boxes. The amount of decay recorded for the second and third inspections is cumulative, that is, it includes decay counts for all previous inspections. Pitting and aging records of the second and third inspections are not cumulative, but instead, are based on actual counts made at the particular inspection. It should be noted that decays other than stem-end rot and Penicillium rot are not listed by specific types, but are included with total of decay in each instance. Thus the total of decay may be somewhat greater than the sum of decay attributed to stem-end rot and Penicillium rots.

Tests were made at Orlando and New York comparing prestorage chemical treatments and phenodor liners on the control of decay of oranges stored at 32° F., A description of the treatments follow:

1. Unwashed. Fruit sorted for size and soundness, but otherwise packed in the same condition as when received at the packinghouse.

2. Washed. Fruit washed, waxed and polished, sorted for size and soundness, but not otherwise treated.

3. Dowicide A-hexamine. Fruit treated by exposure to approximately 2 percent Dowicide A, 1 percent hexamine, and 0.05 percent palmolive soap in the dip tank. Later the fruit was waxed and polished, and sorted for size and soundness.

4. Borax - Dowicide A - hexamine. Fruit treated by exposure to 5 percent borax in dip tank; 24 hours later treated with Dowicide A and hexamine as described in treatment 3; waxed, polished, and sorted for size and soundness.

Sufficient fruit was used to pack 32 1-3/5-bushel Bruce boxes for each treatment. The 32 boxes were subdivided to make 16 boxes packed naked and 16 boxes packed with phenodor liners. The use of phenodor liners made eight different treatments of comparable fruit available for storage at Orlando and New York. Two boxes representative of each treatment were thus available for inspection at each location at the end of eight, twelve, and sixteen weeks' storage respectively.

The test fruit consisted of Valencia oranges grown on sour orange rootstock. It was picked on May 7, packed on May 7 and 8, and placed in storage at Orlando, May 9.

The test boxes for storage at New York were shipped in a commercial carlot on May 11. The packed boxes were precooled 24 hours. Between the time of packing and shipment, fruit temperatures averaged 70° F., and during the transit period 56°. They were stored at New York on May 15.

RESULTS

Comparison of Prestorage Treatments and of Phenodor Liners on the Control of Decay

The Dowicide A-hexamine treatment followed by the use of phenodor liners gave excellent control of decay both at Orlando and New York City. This combination of treatments was even more effective when preceded by a borax dip. Thus, where borax-Dowicide A-hexamine dips were used along with phenodor liners oranges stored at New York City showed only 1.5 percent decay after sixteen weeks at 32° followed by seven days at 70° F.; and oranges stored under the same conditions at Orlando showed no decay. Records of decay for all treatments are summarized in tables 1 and 2. It will be seen from the data therein that in only one instance out of eighteen sets of comparisons did the Dowicide A-hexamine treatment when used alone fail to give good control of decay. This exception occurred in the New York City lot that was stored for sixteen weeks followed by seven days at 70° (table 2).

Figure 1 shows that the Dowicide A-hexamine treatment and the borax-Dowicide A-hexamine treatments (numbers 3 and 4) greatly reduced decay when comparison was made with the unwashed and washed fruit (treatments 1 and 2). In this connection it should be pointed out that less decay developed in the washed fruit than in the unwashed fruit. The results were more striking in the sixteen weeks' than the eight or twelve weeks' storages. The specific effects of treatments on decay in storage fruit are shown in table 3.

The use of phenodor liners increased the effectiveness of both of the fungicidal treatments (treatments 3 and 4) in reducing the comparatively small amounts of decay found during the holding period at 70° F. (See figure 2). The unwashed and the washed fruit (treatments 1 and 2) also responded remarkedly to the use of phenodor liners and the findings showed a consistent reduction of decay in most of the inspections. The specific effect of the phenodor liners on the control of decay is further emphasized in table 4.

Throughout the entire test the amount of decay that developed during storage was influenced by the length of the storage period. In other words, more decay developed after twelve weeks' storage than after eight weeks' and more after sixteen weeks' than after twelve weeks'. Decay likewise increased as the fruit was held at 70° following removal from cold storage. In general, less decay developed in the fruit stored at Orlando than in that stored at New York City.

Phenodor liners had no significant effect on aging; the differences were small and inconsistent. Prestorage packinghouse treatments on the other hand did influence the amount of aging found on the fruits. The results are shown in table 5. It will be noted that the smallest amounts of aging occurred in the washed fruit (treatment 2), and the greatest amount (1 to 8 percent) in the lots treated with Dowicide A-hexamine (treatment 3).

There was evidence at Orlando that some rind burn resulted from the Dowicide A-hexamine treatments. The injury was mostly around the stem end of the fruit and this was classified in the category as "aging." The borax dip used in connection with treatment 4 decreased the extent and severity of the burn as indicated in table 5.

Skin breakdown in the form of storage pitting was of minor commercial importance, as may be seen in table 6. It should be pointed out that somewhat more pitting was in evidence in the fruit stored for sixteen weeks, than in that stored for eight or twelve weeks. There was a rather consistently smaller amount of pitting in the boxes with phenodor liners than in those of the naked-packed boxes. This undoubtedly was due to the greater prevention of rind dehydration in the lined box.

In the studies at Orlando the loss in weight of the fruit was determined. It was found that the average percent loss amounted to 2.7, 3.5, and 4.1 after eight, twelve, and sixteen weeks' storage, respectively. Prestorage packinghouse treatments had only a slight effect on loss in weight and the average percentages ranged between 3.3 and 3.6 among the treatments. The loss in weight for all periods of storage amounted to 4.2 percent in the naked packs and 2.7 percent in the phenodor-liner-packs. From these figures it can readily be seen that the phenodor liners were effective in reducing the loss in weight of the fruit during storage.

Throughout the entire storage test the unwashed fruit had a duller, less attractive appearance than did the fruit of the other three treatments. The oranges that were not decayed were still fairly fresh in all treatments and were fairly firm even after sixteen weeks' storage.

COMPARISON OF THE PHENODOR-TREATED CORRUGATED FIBERBOARD CARTON WITH THE PHENODOR LINER FOR THE CONTROL OF DECAY

A series of storage tests was conducted at Orlando, Florida, in which comparisons were made between the 4/5-bushel phenodor-treated fiberboard container and the phenodor box liner. The two lots of fruit were of the same crop and were packed by the same shipper. Each subsample usually consisted of three boxes of oranges. Storage was at 32° F. for periods of eight and twelve weeks. Inspections on the fruit were made at the end of each storage period and again after holding three and seven days at 70°.

The results (table 7) show good control of decay during storage of eight weeks and twelve weeks at 32° from the treated cartons and the treated liners. At the final inspection less decay was found in cartons than in lined boxes of oranges.

EFFECT OF GROVE ON STORAGE QUALITY

Storage tests were made to determine the variation in keeping quality of oranges from various groves. The test lots consisted of fruit from ten different groves and were stored for eight weeks and twelve weeks at 32° F. Each subsample consisted of two or three boxes of fruit representive of the quality and pack going to market. The fruit was inspected at the end of each storage period and also after three and seven days at 70°.

The results (table 8) show that very small amounts of decay developed in storage, or after three days at 70° F. However, considerable variations in the amounts of decay were evident after seven days at 70°, especially in the fruit that was stored for twelve weeks. There were comparatively small percentages of total of decay in lots H, I, and F, while higher percentages of decay were found in B, G, E, and C.

EFFECT OF SIZE OF FRUIT ON DECAY IN STORAGE

Storage studies were conducted to determine the effect of size of fruit on storage quality. The subsamples consisted of three boxes of fruit of each of the following sizes: 126, 150, 176, 200, 216, and 250. They were stored for eight and twelve weeks at 32° F. The oranges were inspected at the end of each period and twice after transfer to 70°.

The data (table 9) show that little decay developed in storage. There was a small increase in total decay after holding three days at 70° F. However, decay increased rather rapidly in some of the lots by the end of seven days at 70°, especially those stored for twelve weeks. The greatest amount of decay was found in large sizes (126 and 150). No significant differences were noted in sizes 176 to 250. These findings are in fair agreement with those of 1950, when it was found that the highest amounts of decay occurred in the very large fruit, while the lowest amounts occurred in the small fruit.

RELATION OF ROOTSTOCK TO STORAGE BEHAVIOR

Tests were made at Orlando, Florida, to determine the keeping quality in storage of fruit grown on rough lemon, sour orange, and sweet orange rootstocks. Storage was for eight and twelve weeks at 32° F. The fruit were inspected at the time of removal from storage and after three and seven days at 70°.

Packinghouse treatments were the usual ones. The fruit was washed, waxed, and polished. Each subsample consisted of three boxes of fruit.

The results presented in table 10 show that the rootstocks on which the oranges were grown affected the total percentage of decay. The amount of decay was low at the time of removal from storage. It may be observed that a slightly higher percentage of decay was found after the three-day holding test, and a still greater amount after seven days at 70° F. More decay developed during the seven-day holding period in fruit stored twelve weeks than in that stored eight weeks. Rootstocks affected the total decay of the fruit and there was more decay in fruit on rough lemon than sour or sweet orange. The differences in storage behavior between fruit on sour and sweet orange rootstocks were small and insignificant. The results further show that aging and storage pitting were unimportant and that the small amounts found were not closely related to rootstocks.

COMMERCIAL STORAGE OF SIX CARLOADS OF ORANGES

A study was made on the commercial storage of six carloads of oranges in the same manner as during the previous season. Although the cars were handled in a strictly commercial manner, complete records were taken from the time the fruit entered the packinghouse until it was removed from storage and sold.

One carload packed in Bruce boxes with phenodor (diphenyl-treated) liners was stored at Providence, Rhode Island, April 26, and sold in early July after nine to ten weeks' storage at about 32° F. Sample boxes examined on four occasions, either in storage or at New York City where they were delivered by refrigerated truck, remained in good condition without developing an appreciable amount of skin breakdown. An average of 3 percent decay was found after six weeks, and 4.6 percent after nine weeks' storage. No further records were obtained, but it was understood that the carload was to be placed on sale soon after the time of the last inspection.

Four carloads packed either in standard or Bruce boxes, were placed in storage at New York City (Newark, N. J.) between May 7 to June 4, and removed between June 21 to July 12, after four to seven weeks' storage at about 32° F. Phenodor liners were used in two loads; and the fruit was packed in two diphenyl-treated paper bags per Bruce crate, with the bags separated by a center partition in a third load. Inspections were made at the time of storage, during the storage period, and on the New York City sales pier. Decay at the time of arrival at storage ranged from a trace to 1 percent and at the time of removal from a trace to 3.5 percent. Except in one carload, where 7.3 percent skin breakdown was found at the time of sale, neither aging nor pitting developed to an important extent during the storage period.

Since all four cars were sold at auction, price comparisons can be made between date stored and date sold. All figures are taken from the New York Daily Fruit Reporter and are for the variety and pack represented in the test car.

Car 1, containing brands A, B, and C, was stored May 7, on which date 13,300 standard boxes of Indian River Valencias were sold at $4.55 per box. Four cars of the same brands as those in the test car were sold on May 7:

> Brand A sold at $5.33, B at $4.47 (1 car only), and C at $4.43 per box.
>
> The test car was sold June 21 for the following prices per box: A at $5.03; B at $4.00, C at $3.97.

Another car, containing two of the same brands, was sold on June 21 as follows: Brand A at $5.43, C at $4.27. The fruit in this carload had been picked later than that in the test car and had been held in storage at Jacksonville, Florida, for one week; the fruit had a fresher appearance and less decay than that in the test car (3 percent decay in latter). On June 21, 3,830 standard boxes of Valencias were sold at $4.81.

Car 2, was stored May 15, on which date 4,210 Bruce boxes of Valencias were sold at $4.88.

> The test car was sold on June 21, at $3.31. This car was the one with 7.3 percent skin breakdown and was also the one in which the oranges were packed in two paper bags per Bruce box with a partition. Another car of the same brand as that stored was sold on the same date at $5.10. A total of 5,960 Bruce boxes of Valencias sold on June 21 at $4.36.

Car 3, containing brands A, B, and C, was stored May 22, on which date 7,505 standard boxes of Indian River Valencias were sold at $4.98. Three cars of the same brands as in the test car were sold on May 22 for: Brand A at $5.49, B at $4.92, C at $4.64.

> The test car was sold July 12 for the following: Brand A at $5.62, B at $4.90, C at $4.35. On the same day 2,640 standard boxes of Indian River Valencias were sold at $4.71.

Car 4, was stored June 4, on which date 15,770 Bruce boxes of Valencias were sold at $3.87. A carload of the same brand as that in the stored car was sold on June 4 at $3.82.

> The test car was sold July 3 at $1.58. The fruit had a good appearance, although it contained 3.5 percent decay. On the same date 2,665 Bruce boxes of Valencias were sold at $3.12. The comparatively low price received for the stored carload cannot be attributed to the condition or appearance of the fruit. It may be pointed out that the day of sale immediately preceded the July 4 holiday and the market was slow.

Another carload of Valencia oranges, stored at New York City (Newark, N. J.) in cooperation with the Citrus Container Institute, consisted of 1,056 corrugated phenodor-treated fiberboard cartons of 4/5-bushel size. The fruit itself had received the Dowicide A-hexamine fungicidal treatment. The cartons were loaded in a fan car in such a manner as to provide vertical "chimneys" to facilitate transit cooling. The load was precooled on track for 24 hours by means of car fans, shipped under standard refrigeration, and unloaded into storage five days after the end of the precooling period.

Fruit temperatures at the time of loading ranged from 81° to 92° F. and averaged 86.4°. Fruit temperatures were taken manually while the car was being unloaded by cutting a slit in the carton and inserting a fruit thermometer into an orange adjacent to the carton wall. Temperatures were several degrees higher in oranges adjacent to walls farthest removed from the chimneys than in oranges adjacent to carton walls forming the inner wall of the chimney. Top layer temperatures ranged from 55° to 60° F., middle layer from 59 to 69°, and bottom layer from 47° to 51°. The average of 32 readings in the load was 58°. There was considerable variation in the amount and degree of aging and pitting at several inspections made during the storage period although there was no evidence that it became worse during storage. In this connection it should be noted that the carlot was pooled from seven sources. Only 1.3 percent decay was found at the end of a six-week storage period.

On the day the car went into storage (June 18) 9,520 Bruce boxes of Valencias were sold at $4.93 each. The test car was sold on August 1 at $2.64 per carton, equivalent to $5.28 per Bruce box. On the same day 4,080 Bruce boxes were sold at $6.23 each.

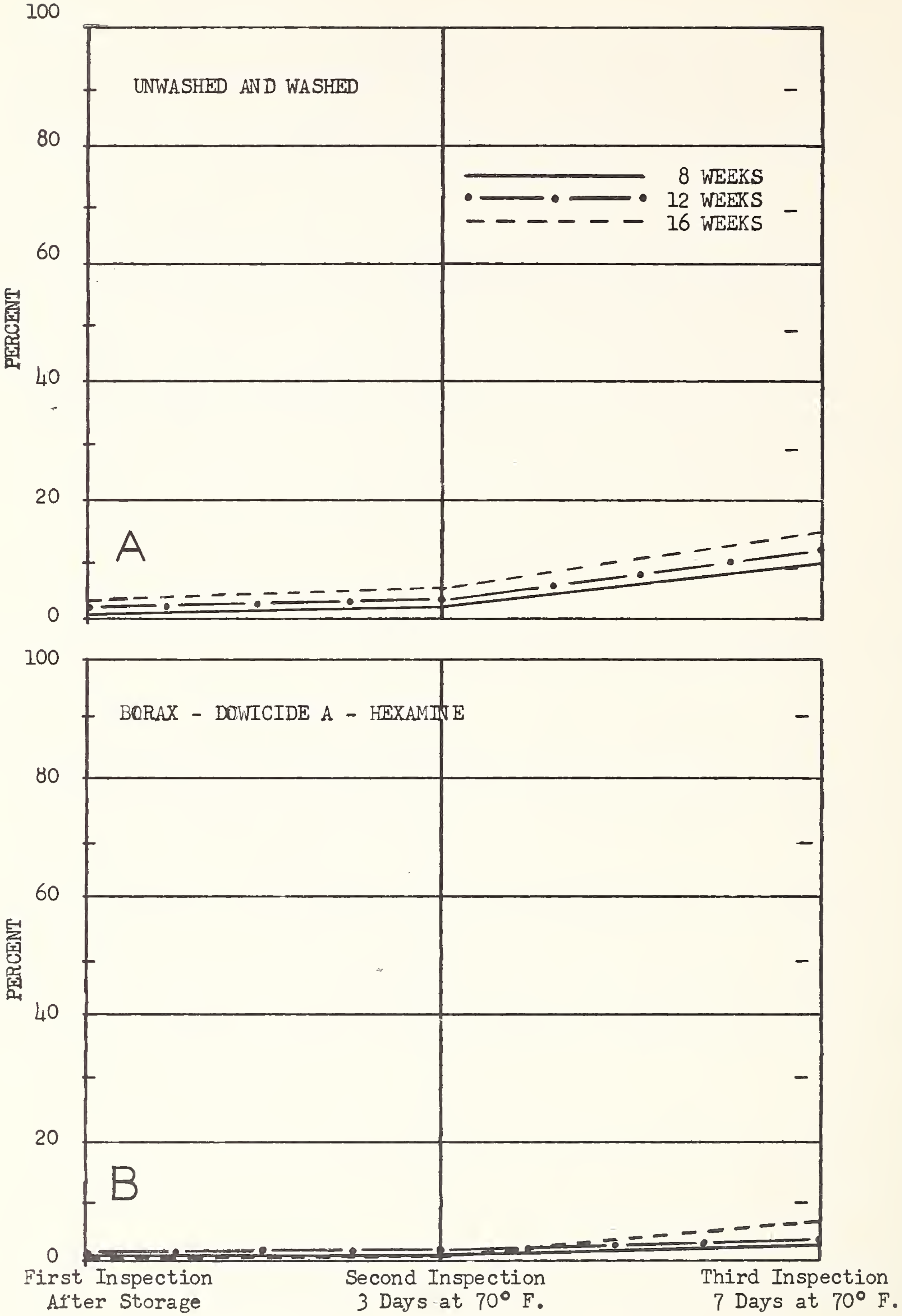

Figure 1. Comparison of prestorage packinghouse treatments on the development of decay during the holding period following storage at 32° F.: A, unwashed and washed; B, Dowicide A-hexamine with and without borax.

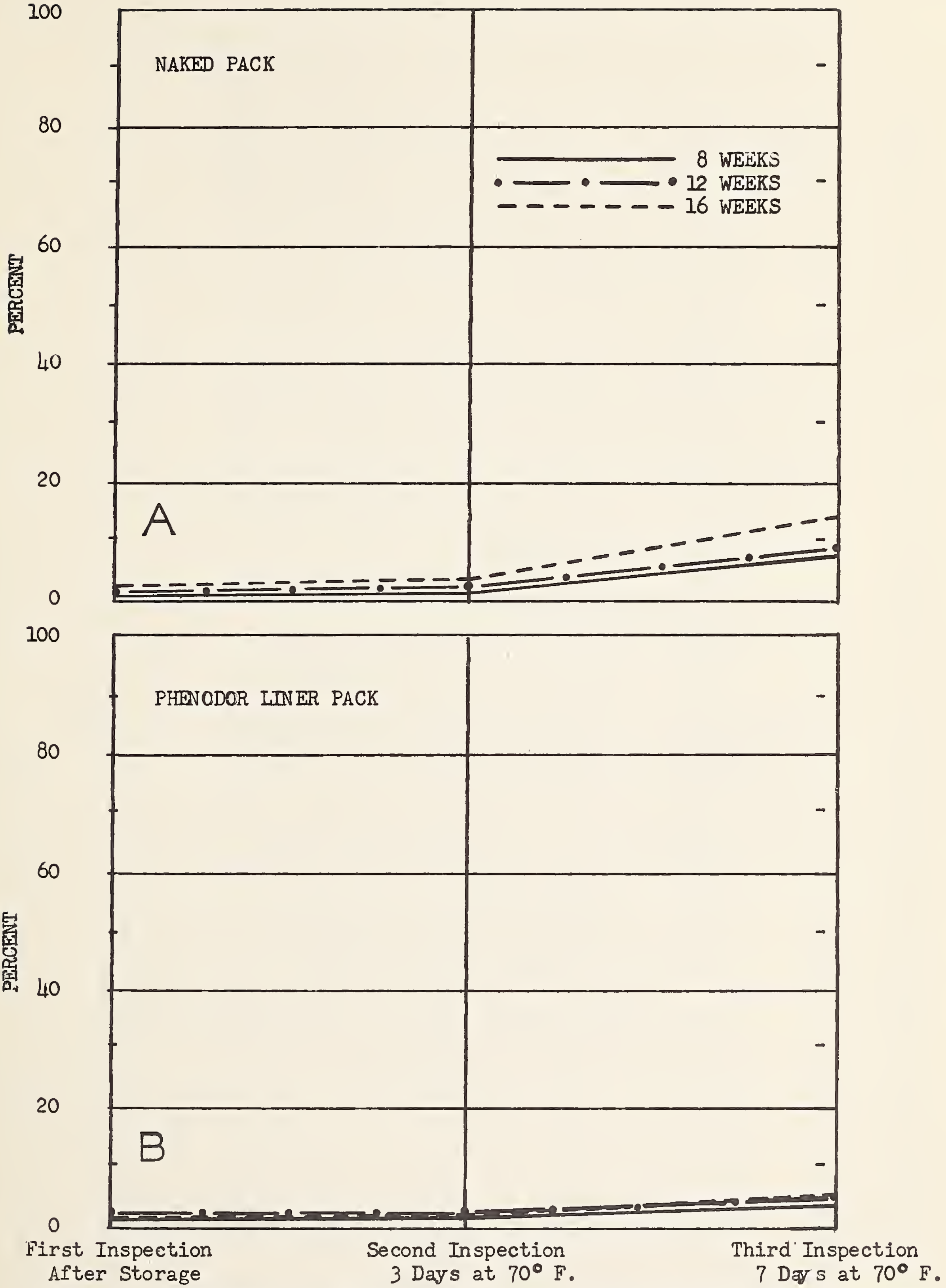

Figure 2. Comparison of naked-pack and phenodor liner-pack on the development of decay during the holding period following storage at 32° F.: A, naked-packed fruit; B, phenodor liner-packed fruit.

TABLE 1. The effect of prestorage packinghouse treatments and phenodor liners on the total decay of oranges stored at Orlando, Florida, 1951. 1/

Prestorage treatment	Pack	8 Weeks storage at 32° F. plus-			12 Weeks storage at 32° F. plus-			16 Weeks storage at 32° F. plus-		
		0 days at 70° F.	3 days at 70° F.	7 days at 70° F.	0 days at 70°F.	3 days at 70° F.	7 days at 70° F.	0 days at 70° F.	3 days at 70°F.	7 days at 70° F.
		Percent			Percent			Percent		
Unwashed	Naked	.2	1.3	7.3	.3	.5	7.9	1.3	3.6	14.3
Unwashed	Liner	.5	1.3	4.9	1.0	3.1	6.5	1.5	3.3	9.7
Washed	Naked	.7	1.0	4.6	1.0	1.8	3.8	1.3	2.3	8.0
Washed	Liner	.2	.2	1.4	.5	.8	3.1	1.0	1.8	3.8
Dowicide A-hexamine	Naked	0	0	2.2	0	.5	3.3	.8	1.0	4.1
Dowicide A-hexamine	Liner	0	0	1.2	.5	.5	1.5	.5	.8	2.0
Borax-Dowicide A-hexamine	Naked	0	0	.5	.2	.5	2.4	.5	.5	4.1
Borax-Dowicide A-hexamine	Liner	0	0	1.2	1.3	1.5	2.0	0	0	0

1/ Data based on averages of subsamples (2-box lots).

TABLE 2. The effect of prestorage packinghouse treatments and phenodor liners on the total decay of oranges stored at New York, New York, 1951. 1/

Prestorage treatment	Pack	8 Weeks storage at 32° F. plus-			12 Weeks storage at 32° F. plus-			16 Weeks storage at 32° F. plus-		
		0 days at 70°F.	3 days at 70° F.	7 days at 70° F.	0 days at 70° F.	3 days at 70° F.	7 days at 70° F.	0 days at 70°F.	3 days at 70° F.	7 days at 70°F.
		Percent			Percent			Percent		
Unwashed	Naked	1.4	3.6	21.6	3.3	7.1	24.2	8.2	12.3	32.0
Unwashed	Liner	1.6	2.7	7.4	.3	1.5	8.9	2.6	4.6	14.9
Washed	Naked	2.2	3.6	20.2	3.6	5.1	23.7	6.1	6.9	28.1
Washed	Liner	2.2	3.0	6.8	4.6	4.8	10.7	.8	1.1	5.6
Dowicide A-hexamine	Naked	1.7	1.7	7.0	.3	1.1	6.6	.5	.5	21.4
Dowicide A-hexamine	Liner	.2	.7	2.4	.8	1.1	3.8	.3	1.2	4.3
Borax-Dowicide A-hexamine	Naked	.5	.5	3.4	1.3	2.8	4.1	.3	1.0	8.2
Borax-Dowicide A-hexamine	Liner	2.4	3.1	4.1	1.8	2.3	3.6	.8	.8	1.5

1/ Data based on averages of subsamples (2-box lots).

TABLE 3. The effect of prestorage packinghouse treatments on the reduction of decay in oranges, 1951. 1/

	8 Weeks at 32° F. plus 7 days at 70° F.	12 Weeks at 32° F. plus 7 days at 70° F.	16 Weeks at 32° F. plus 7 days at 70° F.
Percent decay in unwashed and washed packs (Treatments 1 and 2)	9.3	11.1	14.6
Percent decay in borax - Dowicide A - hexamine pack (Treatments 3 and 4)	2.8	3.4	5.7
Percent reduction in decay by use of borax - Dowicide A - hexamine (Treatments 3 and 4)	70.4	69.3	60.8

1/ Data based on averages obtained at Orlando, Florida, and New York, New York, for all of the unwashed - washed packs, and for all of the borax - Dowicide A - hexamine packs.

TABLE 4. The effect of phenodor liners on the reduction of decay in oranges stored at 32° F., 1951. 1/

	At 3-day inspection			At 7-day inspection		
	Stem-end rot	Penicillium rot	Total of decay	Stem-end rot	Penicillium rot	Total of decay
Percent decay in naked pack	.7	.8	2.0	4.3	3.5	8.9
Percent decay in liner pack	.5	.4	1.4	1.7	1.3	3.8
Percent reduction in decay by use of liner	20.1	49.0	31.8	59.4	63.1	56.7

1/ Data based on averages obtained at Orlando, Florida, and New York, New York, for all prestorage treatments and for all storage periods.

TABLE 5. The effect of prestorage packinghouse treatments on development of severe aging, 1951. 1/

Prestorage treatment	8 Weeks storage at 32° F. plus-			12 Weeks storage at 32° F. plus-			16 Weeks storage at 32° F. plus-		
	0 days at 70° F.	3 days at 70° F.	7 days at 70° F.	0 days at 70° F.	3 days at 70° F.	7 days at 70° F.	0 days at 70° F.	3 days at 70° F.	7 days at 70° F.
	Percent			Percent			Percent		
Unwashed	.1	.8	.5	1.1	2.7	3.2	2.0	4.1	4.4
Washed	.05	.3	.2	.3	.4	.2	.3	.5	.5
Dowicide A - hexamine	1.0	2.8	2.7	2.8	4.1	7.5	3.4	5.9	8.0
Borax - Dowicide A - hexamine	.05	1.6	1.7	1.2	2.2	3.5	1.1	2.2	4.7

1/ Data based on averages of naked packs and phenodor liner packs obtained at Orlando, Florida, and New York, New York.

TABLE 6. The effect of prestorage packinghouse treatments on development of severe pitting, 1951. 1/

Prestorage treatment	8 Weeks storage at 32° F. plus-			12 Weeks storage at 32° F. plus-			16 Weeks storage at 32° F. plus-		
	0 days at 70° F.	3 days at 70° F.	7 days at 70° F.	0 days at 70° F.	3 days at 70° F.	7 days at 70° F.	0 days at 70° F.	3 days at 70° F.	7 days at 70° F.
	Percent			Percent			Percent		
Unwashed	.5	1.2	.9	1.3	.9	.9	3.0	3.9	3.3
Washed	.5	.6	.4	.9	.7	.9	.4	.8	.6
Dowicide A - hexamine	.2	1.5	.5	.9	.8	1.7	2.8	2.5	3.4
Borax - Dowicide A - hexamine	.3	.6	.3	.4	.6	1.6	2.0	2.3	3.1

1/ Data based on averages of naked packs and phenodor liner packs obtained at Orlando, Florida, and New York, New York.

TABLE 7. Comparison of phenodor-treated fiberboard cartons with phenodor-treated box liners for the control of decay in fruit stored at 32° F. 1/

Treatment	Weeks stored	First inspection after storage			Second inspection after three days at 70° F.			Third inspection after seven days at 70° F.		
		Severe aging	Moderate and severe pitting	Total of decay	Severe aging	Moderate and severe pitting	Total of decay	Severe aging	Moderate and severe pitting	Total of decay
			Percent			Percent			Percent	
Cartons	8	.8	0	.8	0	0	1.1	.8	0	3.5
Cartons	12	0	2.1	.5	.5	2.4	.8	2.7	.8	6.4
Liners	8	.8	.4	0	1.1	.4	.2	.6	.4	5.9
Liners	12	.2	1.3	.4	1.2	2.5	1.7	1.0	1.5	17.9

1/ Figures based on averages of subsamples comprising from 525 to 750 fruits each.

TABLE 8. Differences between groves in respect to decay in fruit stored at 32° F. for eight and twelve weeks. 1/

Grove	Rootstock	8 Weeks storage at 32° F. plus-			12 Weeks storage at 32° F. plus-		
		0 days at 70° F.	3 days at 70° F.	7 days at 70° F.	0 days at 70° F.	3 days at 70° F.	7 days at 70° F.
		Percent			Percent		
A	Rough lemon	0	.3	10.2	1.2	3.4	21.8
B	do	.9	3.1	17.5	2.5	5.9	38.1
C	do	.6	1.5	12.0	0	3.4	24.3
D	do	0	.2	5.9	.4	1.7	17.9
E	Sour orange	0	.9	16.1	.9	4.3	25.3
F	do	0	1.2	6.2	1.2	2.8	7.4
G	do	.6	2.2	14.2	.8	3.4	26.6
H	do	.2	.4	2.1	.4	1.0	4.6
I	Sweet orange	0	.4	3.8	.4	1.0	5.2
J	Grapefruit	.9	2.2	7.1	1.8	4.3	9.8

1/ Figures based on averages of subsamples (2-box lots).

TABLE 9. The relation of size of fruit to decay in fruit stored at 32° F. for eight and twelve weeks. 1/

Size of fruit	8 Weeks storage at 32° F. plus-			12 Weeks storage at 32° F. plus-		
	0 days at 70° F.	3 days at 70° F.	7 days at 70° F.	0 days at 70° F.	3 days at 70° F.	7 days at 70° F.
	Percent			Percent		
126	0	0	5.9	0	1.3	35.9
150	.2	.4	8.9	.7	1.6	22.9
176	.2	.6	5.2	.2	1.1	13.3
200	.3	1.0	5.9	.3	.8	16.8
216	.8	.9	4.5	.6	1.9	16.8
250	.7	1.3	4.5	.9	1.7	17.1

1/ Data based on averages of subsamples (3-box lots).

TABLE 10. Relation of rootstocks to aging, pitting, and total of decay of oranges stored at 32° F. 1/

Rootstock	Weeks stored	First inspection after storage			Second inspection after 3 days at 70° F.			Third inspection after 7 days at 70° F.		
		Severe aging	Moderate and severe pitting	Total of decay	Severe aging	Moderate and severe pitting	Total of decay	Severe aging	Moderate and severe pitting	Total of decay
		Percent			Percent			Percent		
Rough lemon	8	.8	.4	0	1.1	.4	.2	.6	.4	5.9
do	12	.2	1.3	.4	1.2	2.5	1.7	1.0	1.5	17.9
Sour orange	8	0	0	.2	0	0	.4	0	0	2.1
do	12	.4	.4	.4	.2	.6	1.0	1.0	.4	4.6
Sweet orange	8	.2	.2	0	.6	.4	.4	1.0	.6	3.8
do	12	0	.4	.4	.4	.4	1.0	.6	.4	5.2

1/ Figures based on averages of subsamples (3-box lots).